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DEPARTMENT OF AGRICULTURE

SEED BRANCH
GEO. H. CLARK, Seed Commissioner

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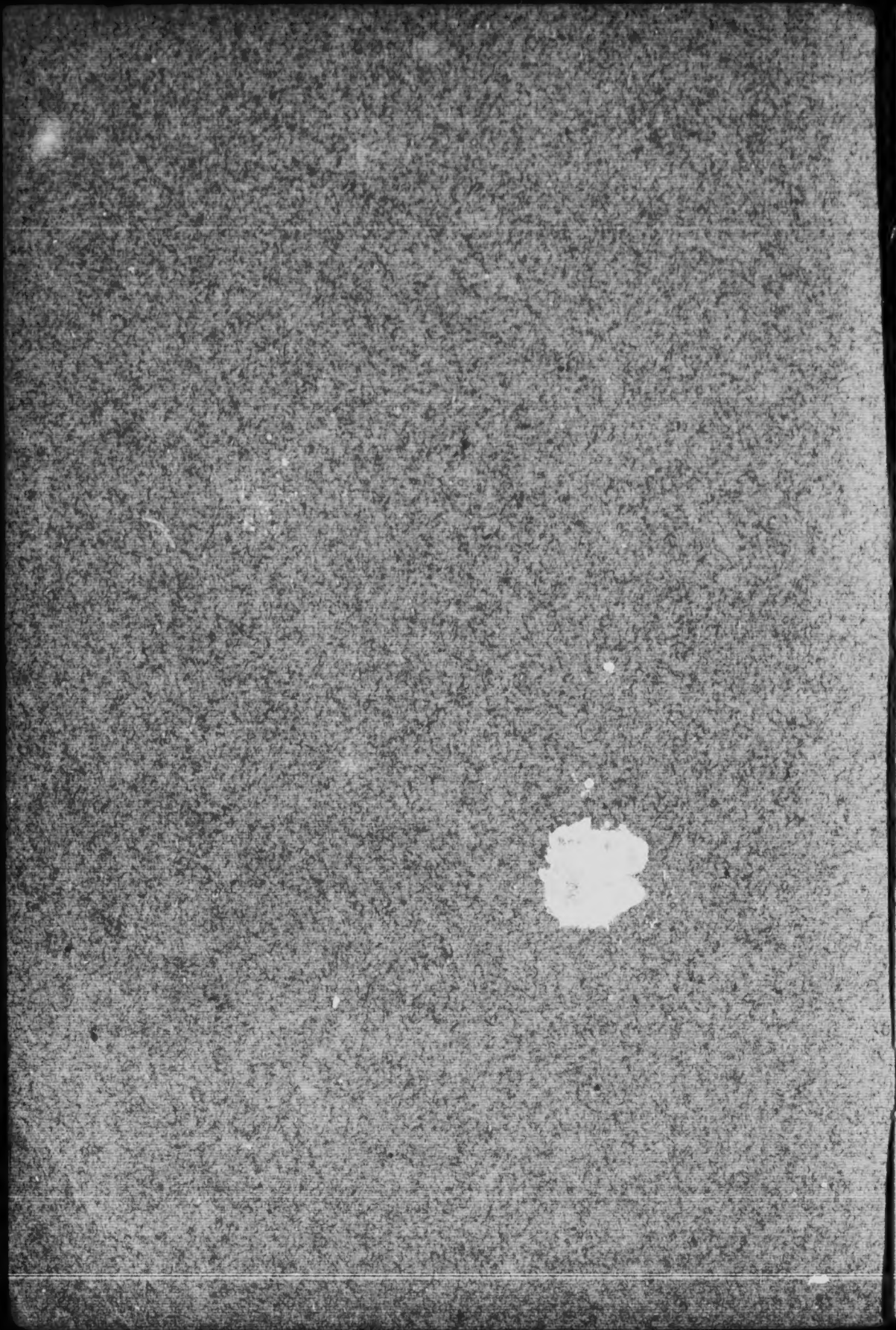
WILD OATS
AND
FALSE WILD OATS

**THEIR NATURE AND DISTINCTIVE
CHARACTERS**

BY
Mr. NORMAN CRIDDLE

BULLETIN No. S-7

Printed by direction of Honourable MARTIN BURRELL, Minister of Agriculture
OTTAWA, FEBRUARY, 1912



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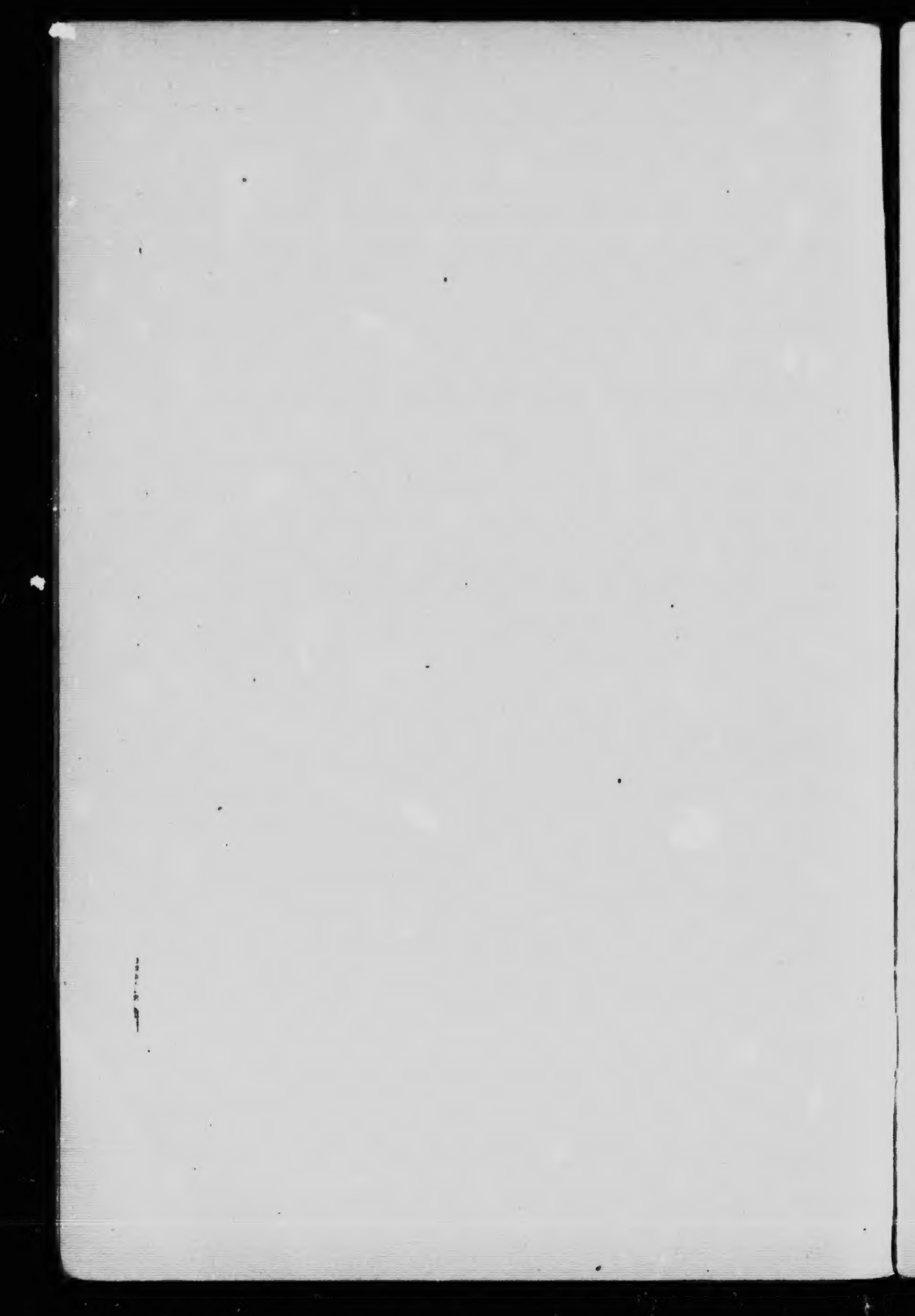
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LETTER OF TRANSMITTAL.

OTTAWA, February 20, 1912.

The HON. MARTIN BURRELL,
Minister of Agriculture.

SIR,—I have the honour to submit the manuscript for a bulletin prepared by Mr. Norman Criddle describing field experiments with Wild Oats and False Wild Oats and the observations and conclusions connected therewith. Mr. Criddle's work throws much light on the heretofore vexed question of whether or not the peculiar forms known as False Wild Oats are dangerous weeds like Wild Oats. I recommend that the manuscript be printed for distribution as Bulletin No. S-7, entitled "Wild Oats and False Wild Oats, their Nature and Distinctive Characters."

Obediently yours,

GEO. H. CLARK,

Seed Commissioner.

PREFACE.

The material presented in this bulletin represents the results of careful investigations and observations covering a period of seven years. The writer, Mr. Norman Criddle, has been connected with the Seed Branch staff for several years in the capacity of Assistant Seed Analyst at the Ottawa or Calgary seed laboratory. He has also made a large number of colored and black and white drawings for "Farm Weeds" and other publications of this Branch. Mr. Criddle is a close student of nature and a very careful observer. During the past few years he has been devoting special attention to a study of Wild Oats and False Wild Oats. The experiments described by Mr. Criddle were conducted on his farm at Treesbank, Man., and his observations and conclusions constitute a very valuable contribution to the knowledge of the subject discussed.

From the knowledge acquired it does not seem probable that False Wild Oats will ever become a serious weed pest, and for the present at least it will not be considered as coming within the meaning of the term "noxious weeds" as applied to the Seed Control Act in official seed testing, but will be classed among the useless or harmful plants, or weeds of secondary importance.

GEO. H. CLARK.

Plate I



Wild Oat
(*Avena fatua*)

Plate II

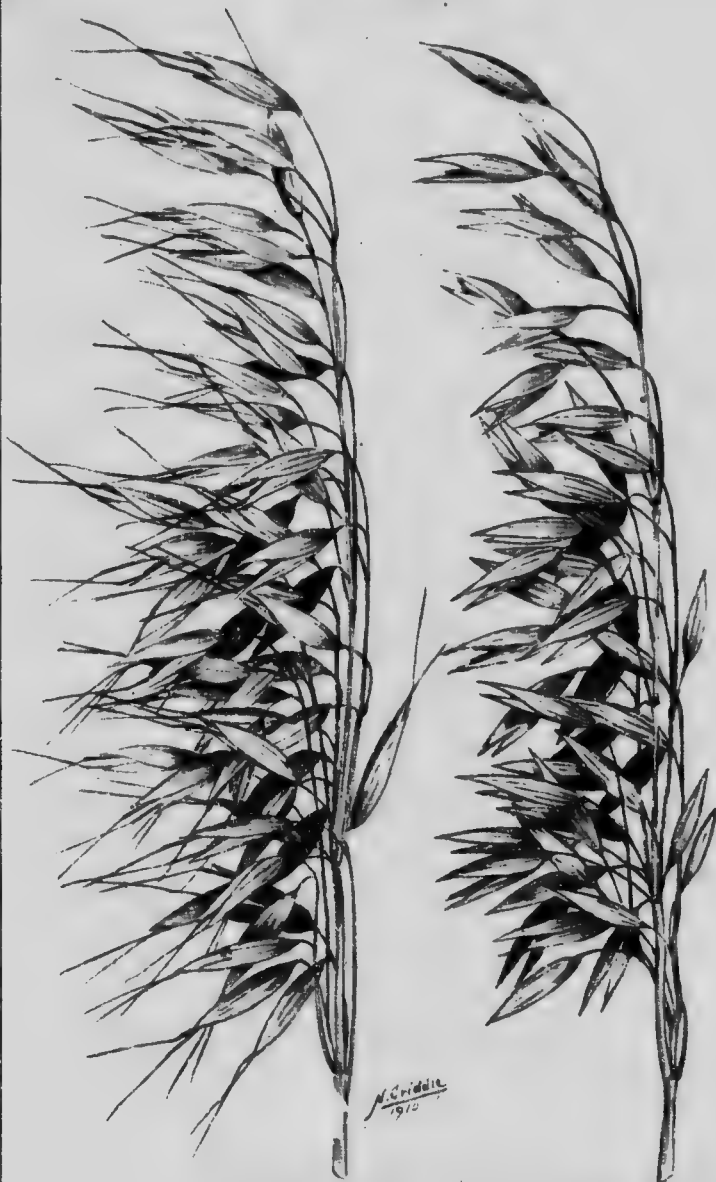


False Wild Oat

Banner Oat

Banner type

Plate III



False Wild Oat

Storm King

Storm King type.

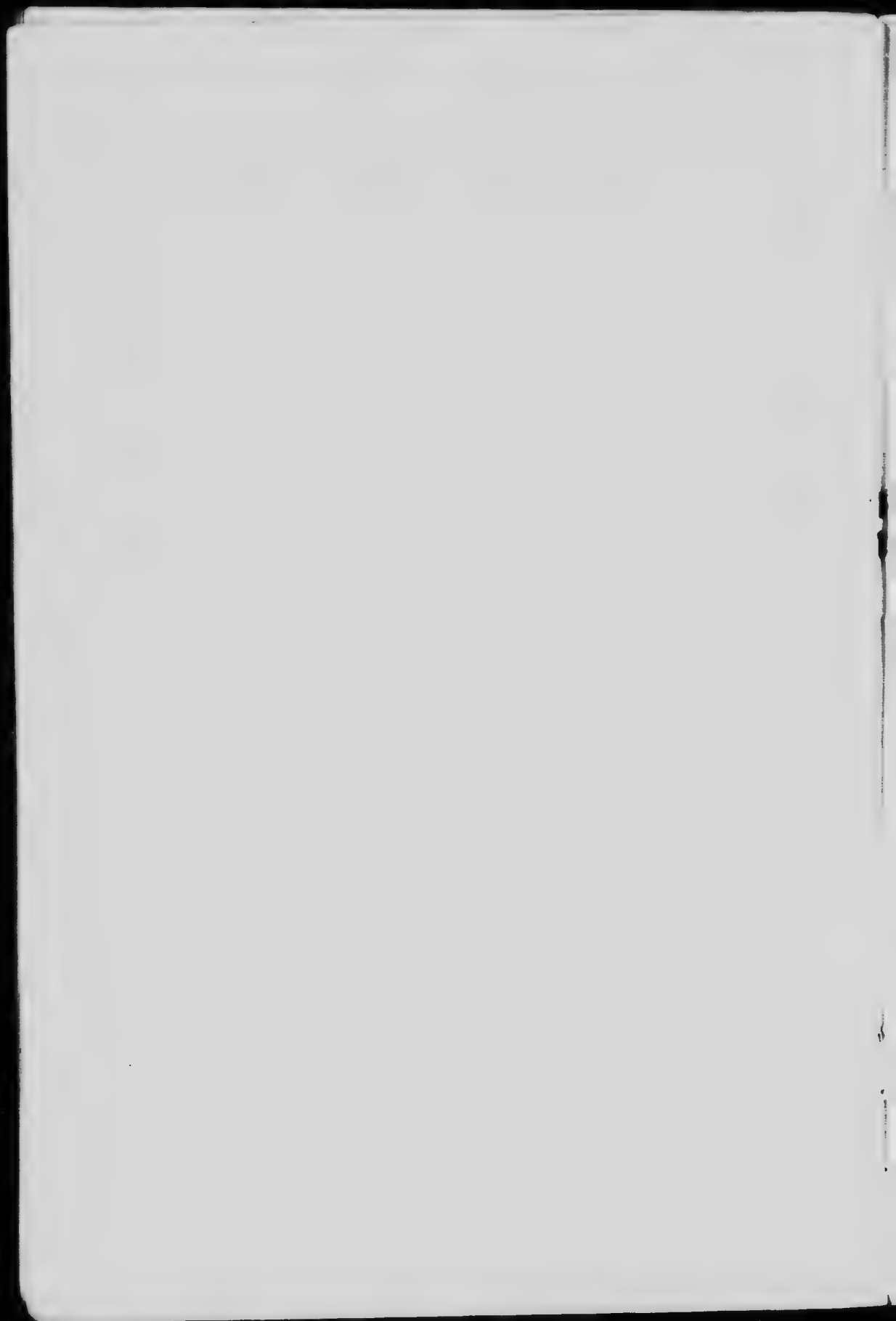


Plate IV



False Wild Oat
(PIN OAT)
STORM KING VARIETY.

1.



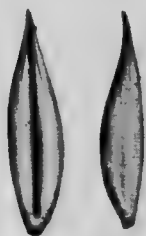
False Wild Oat
STORM KING VARIETY

2.



False Wild Oat
NEWMARKET VARIETY

3.



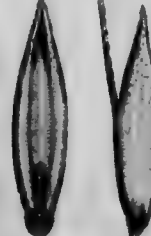
Storm King Oat
(PIN OAT.)

4.



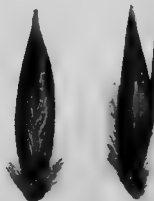
False Wild Oat
BANNER TYPE

5.



False Wild Oat
BANNER TYPE

6.



Wild Oat
(AVENA FATUA)

7.



Wild Oat
HAIRS REMOVED

8.



Wild Oat
HAIRS REMOVED

9.

WILD OATS AND FALSE WILD OATS.

THEIR NATURE AND DISTINCTIVE CHARACTERS.

By MR. NORMAN CRIDDLE.

There are few problems of greater importance to the grain grower of western Canada than that relating to Wild Oats belonging to the species *fatua*. The injury caused by this weed at the present time amounts to an annual loss of thousands, or perhaps millions, of dollars, and the loss is becoming greater yearly as the plant spreads further afield. The question of its control has been discussed frequently, and most practical agriculturists are now aware of the best means to keep the plants within reasonable bounds. I say reasonable bounds because to exterminate them is a task of years which few farmers care to undertake. It is unnecessary therefore, as well as rather out of place, to take up that part of the subject here. But within recent years a question has arisen as to the validity of classing certain forms of oats as Wild Oats and it is chiefly with this side of the problem that I propose to deal.

For several years past I have carried on a number of experiments with Wild Oats and what are termed False Wild Oats, also called Sports, White Wild Oats and Albino Wild Oats, with a view to discovering what their status should be in relation to agriculture, and, further, what relationship—if any—the latter has to the former. With the latter problem I have made no progress due, at least in part, to lack of time, but as I have otherwise brought my experiments to a fairly satisfactory termination, it seems well to relate what the conclusions are so that others may benefit from the knowledge acquired.

Different Types of True Wild Oats.

To the botanist who has followed, even casually, the trend of modern thought in relation to the origin of new forms of species and has read the leading works bearing upon plant breeding and the laws of Mendel, *Avena fatua* (Wild Oats) with its fixed varieties will prove an interesting species, and I have no doubt that accurate study over the wide range inhabited by this plant will reveal many forms, each breeding true within itself.

During the past three years I have grown three fixed varieties for observation and study as follows (see plates I and IV.):—

(1) *Avena fatua* proper. As known to me this is a tall, somewhat slender plant, with bending head and long pedicles bowed down with the weight of the seeds so that the whole head has a drooping appearance. The panicles mature unevenly; seeds borne on the upper part of the heads and at the tips of the branches ripening first and often shelling before those on the lower part are fully matured. Usually too *A. fatua* stands well above cultivated oats. The seed is dark brownish, almost black, turning to a lighter shade at the tip. In form it resembles a common black oat, but is not so plump, and differs from the ordinary cultivated varieties in having a much longer scar at its base, formed somewhat in the shape of a horseshoe, and also in having a long stiff awn and a densely hairy base. In fresh specimens these hairs, which are brown, cover approximately half the oat, and are particularly numerous upon the rachilla

pedicels

(the small footstalk supporting the bosom grain in the spikelet) but the basal sear with its hairs, and the awn also, may be broken off by threshing or handling the grain.

(2) *A. fatua*.—White form. This form resembles exactly the typical *fatua* as described above, excepting in its seeds, which are creamy-white like ordinary white oats. It also seems rather less hairy, but this is partly due to the hairs being white and consequently less conspicuous. This variety breeds true to seeds and on account of its color is difficult to detect in white oats. Beginners are also liable to confuse it with False Wild Oats of the same shade.

(3) *A. fatua*.—Hairy form. This is also very similar to the type described first but differs in the seeds which are densely hairy almost to the tip; the hull is also rather lighter in color. This form has grown true to type for three years.

Another type of *Avena fatua* similar to the foregoing ones but having slaty gray seeds has been grown for two years but proves less fixed. Some of the seeds remain gray while others turn either white or black; possibly some form of combination due to a cross between black and white varieties.

There are also a few other types showing variation from the normal, either in some character or growth, or in the seeds, which may vary in hairiness, some being rather free from hairs while others contain even more than the typical species. These however, have proved to be of a fluctuating nature and in consequence have been discarded.*

Appearance of False Wild Oats.

For a number of years past there has been some difficulty in judging oats as seed pairs due to there being found among the samples, kernels showing the outward appearance of Wild Oats; that is, having a long, twisting awn and characteristic horseshoe base. These at first were unhesitatingly classed as Wild Oats, but later doubts arose as to the correctness of this and eventually most of those who had had practical experience in the matter arrived at the conclusion that the forms involved were not Wild Oats, but represented some form of deviation from type which affected, apparently, the seed coat only and left the seed proper unaltered. I found by experiment that any type of oat showing these retrogressive characters when grown would produce a plant of typical appearance which, but for the long awn, could not be told from the cultivated variety from which it originated. It had also a seed of the same shape and plumpness but in addition to the long awn had a horseshoe shaped base, thus resembling a Wild Oat excepting in size. Apart from this, however, all the forms examined by me have been less hairy than a Wild Oat, especially round the base. (See plates II, III and IV.)

Experiments in Growing Different Types of False Wild Oats

These facts were arrived at after a few years study but as it seemed wise to make further tests, so as to leave less room for error, all the available material has been collected and grown with the following results:—

(1) Banner type. Three examples were tested, one for seven years and two for three. All have proved fixed.

(2) Newmarket of Abundance type. Three examples tested, one for five years, the others for two. They have shown no change in appearance.

(3) Old Island Black type. One example from eastern Canada grown for two years. No change.

* EDITOR'S NOTE.—It may be stated in this connection that our best botanical authorities have failed, up to date, to adopt a uniform classification of the numerous known species, varieties and types of Wild Oats, several of which are considered as pure by some authors and as hybrids by others.

(4) A black oat, name unknown. This might easily be mistaken for a variety of *A. fatua* or true Wild Oats which it more closely resembles than any other False Wild Oats that I know of. It may be separated from the Wild Oats by the following features: Plant fully six inches shorter; stem stouter in proportion; pedicles not so long, giving the whole head a more compact and upright appearance; seeds dark as in *fatua* but less hairy especially round the scar, also stouter and more distinctly ribbed. This form has grown true to type for two years.

(5) Storm King type. Two examples grown for four and seven years respectively. No change.

The first four of the above mentioned varieties belong to the *sativa* (spreading panicle) form of growth, the last to the *Orientalis* (side oats) type.

In addition to these I received from Mr. A. Cooper of Treesbank, Man., some examples of Banner oats grown on land free from Wild Oats and supposedly from pure seed, showing a tendency in the direction of the wild type, having a rather more open basal scar and larger awn than is usual in the cultivated form. The first year these were grown about two per cent developed into fully formed False Wild Oats while a majority of the others remained as before. A certain number, however, developed stronger awns while others became entirely awnless. The more developed oats were again sown in 1911 and produced about 20% of False Wild Oats, some 40% of the long awned kinds and the remainder either with no awns or with the usual weak ones generally found on the primary oat on the upper grains in the head. Some of the original seed was also sown and showed less than one per cent of False Wild Oats but produced instead a dwarf type not above six inches in height which though developing sufficiently to reveal the usual long awns of False Wild Oat failed to produce germinable seeds. The proportion of plants of this kind amounted to nearly one per cent.

Distinguishing Characters of True and False Wild Oats.

The problem of distinguishing a true Wild Oat from a False Wild Oat is an important one from the farmer's standpoint. In the growing stage this is a comparatively simple matter as the False Wild Oat will have the manner of growth characteristic of a cultivated oat, in contrast to that of the Wild Oat previously described, but in the seed form the difficulty is much greater, and there seems to be no fixed character by which to distinguish between some of the smaller varieties of False Wild Oats and the true wild forms. With the larger sorts now grown so extensively the difficulty of distinguishing them is not so great, and an experienced eye will at once detect the False Wild Oat by its larger size and its usually close resemblance to the cultivated variety in which it is found. Generally speaking too the lemma or outer seed coat is more open in front with cultivated forms and False Wild Oats so that the palea or inner coat is broadly visible whereas in Wild Oats the edges of the lemma almost meet. There are, however, some exceptions to this rule. The seeds of False Wild Oats carefully picked will show the very characteristics of true Wild Oats, though somewhat less pronounced in most cases, but will mostly correspond with the cultivated variety in which they appear in size, plumpness, color and smoothness of the glumes.

Difference in Germinating Qualities.

Germination tests will also reveal the nature of an oat if recently ripened owing to the readiness with which False Wild Oats grow in comparison with true Wild Oats but unless at least one hundred seeds are tested the result will not be satisfactory. One of the worst traits in *Avena fatua*, true Wild Oats, is the

power of its seed to resist the ordinary factors of germination. Thus newly ripened seed usually fails to germinate under any conditions or at most does so to the extent of only about one per cent. On the other hand if kept for some three months or more approximately 80% will grow. Some seeds, however, may not germinate for several years and if buried deeply they are said to remain dormant for a very long time. Fortunately this is not a character of False Wild Oats.*

False Wild Oats not Dangerous.

From an agricultural point of view an interesting point is the lack of increase in False Wild Oats. This is extremely important because it is the power, or lack of it, to increase faster than cultivated varieties that would make them a dangerous or comparatively harmless plant. The fact that seeds of False Wild Oats germinate readily when fresh, as do ordinary cultivated oats, is sufficient reason for considering them as not being a noxious weed seed impurity and as they are large and contain as much nourishment as the cultivated varieties from which they are produced, so far as we know without chemical analysis and laboratory tests to determine the per cent hull, there can be little complaint against them on that account.** Probably the chief objection to them is the long stiff awns—which, however, usually become broken off in threshing—and their tendency to shell out, due to the awns. As a matter of fact, it is this very characteristic of shelling that really keeps them down as owing to it they naturally drop to the ground before other oats and not having the power of Wild Oats to resist germinating they grow in the autumn and are killed by frost before they have time to ripen their seeds.

* **EDITOR'S NOTE.**—Besides the numerous laboratory experiments showing that False Wild Oats germinate as readily as do the common cultivated oats, and the work done by Mr. Criddle, mention may be made here of a conclusive field experiment conducted at Guelph, Ont., by Mr. E. A. Howes, now Assistant Seed Analyst of the Seed Branch, Department of Agriculture, Ottawa. A mixture of False Wild Oats of different types and cultivated oats was sown in rows on a garden plot of sixteen square yards. Another plot similar in size and of the same character of soil was sown with common Wild Oats. Both crops were allowed to shell freely when ripe and after the straw was removed, the soil in both cases was given a surface cultivation sufficient to cover most of the seed scattered about. A fine fall growth of cultivated oats and False Wild Oats developed in a short time but not a single plant could be found in the Wild Oat plot throughout the autumn. This growth was winter killed and in the spring the soil was stirred up with a rake. In the Wild Oat plot numerous plants appeared, though not so thickly nor so uniformly as in the case of the other plot during the previous autumn but not one plant appeared in the cultivated oats and False Wild Oats plot. In order to keep watch for plants from seed of retarded germination cabbages were set out on the whole strip. No oats came up in the plot where cultivated oats and False Wild Oats had been grown, but Wild Oats appeared in the other plot up to July 28th. In this case False Wild Oats and the cultivated oats from which they came acted alike, while the Wild Oats acted quite differently.

An experiment in spring germination was conducted in 1910. Wild Oats from Brandon, Man., cultivated oats from the Swedish Select, Early Ripe and Irish Victor varieties and False Wild Oats from those three varieties, all the seeds taken from the harvest of 1909, were sown on May 10th, thirty seeds in each plot. The results showed a lower percentage, as well as a slower germination of the Wild Oats, but practically no difference between the final percentage germination of the False Wild Oats and the cultivated varieties, although the germination was somewhat slower with the False Wild Oats.

A summary of the results of all the experiments along this line indicate conclusively that False Wild Oats are quite distinct from true Wild Oats in their responsiveness to the ordinary factors of germination, but are very similar to the cultivated varieties in this regard.

** **EDITOR'S NOTE.**—Tests at the Ottawa seed laboratory of two samples of False Wild Oats indicate that the per cent of hull is greater in these forms than in the ordinary grain of the variety in which they develop. A sample of False Wild Oats, originating from Banner oats grown in Manitoba tested 34.6 per cent hull, while the average for the Banner variety is about 28.5 per cent. The sample of False Wild Oats from the Storm King variety tested showed a strongly marked tendency toward inferior quality. Eighty-three per cent of the grains were double and in nearly all cases the primary grain was entire, kernelless or the kernel was very small. The sample tested 47.1 per cent hull, while the average for the Storm King variety is about 32 per cent. This apparent tendency toward an increase in per cent of hull in single grains and increase in the proportion of kernelless double grains, with some varieties at least, is very objectionable.

About the only practical means to prevent or restrict the occurrence of these undesirable forms is to refrain from growing such varieties as observation shows to be specially inclined to produce them and, where practicable, to remove them by hand from the growing crop or seed grain. Field experiments indicate that the seeds of False Wild Oats that shell out and fall to the ground could be destroyed by after-harvest cultivation to induce germination. On the other hand they tend to confirm the opinion that very little can be accomplished toward destroying Wild Oats by this method.

The Probable Origin of False Wild Oats.

The origin of these False Wild Oats still remains doubtful. It is possible that they may be the result of a cross between the wild and cultivated species, but in view of the seeming fact that they are no more numerous in oats which are known to have been brought into contact with Wild Oats than those kept free from them, and further as some varieties seem to contain far more False Wild Oats than others, it seems hardly likely that they are produced in this manner.*

Conclusions.

My chief object in presenting this material has been to show (1) that there is no longer any necessity for classifying False Wild Oats as Wild Oats, and (2) that their characteristic manner of growth, &c., gives little cause for apprehension or for supposing that they will ever become sufficiently numerous to be classed as anything but an impurity, just as a black oat in a white variety would be.

In conclusion I desire to express my indebtedness to Mr. G. H. Clark, the Seed Commissioner, and to Mr. G. Michaud, Botanist and Seed Analyst of the Seed Branch, for their kindness in placing the whole of their samples at my disposal.

***Editor's Note.**—The problem of how to prevent the multiplication of False Wild Oats and destroy them is a most enigmatical one and it will remain so until more definite knowledge is acquired in regard to their relation to true Wild Oats and the cultivated varieties. First of all the problem of the origin of the cultivated oats should be defined and agreed upon by the cereal breeders and scientists. This problem solved, a few plausible explanations of the origin of False Wild Oats by atavism or retrogression could be accepted, also if it could be satisfactorily proven that some of our cultivated varieties of oats were originated from or have been improved by means of crossing with Wild Oats. These hypotheses are generally accepted on account of their plausibility, but as far as we know they have never been proved so as to furnish the basis of a reliable solution of this very important problem. Another hypothesis, the accidental or natural crossing of cultivated oats with Wild Oats, may seem logical and might be accepted were it not known that in some countries, as in Sweden for instance, False Wild Oats also appear amongst cultivated varieties which, as far as human control can be relied upon, have never come in contact with Wild Oats. Dr. H. Nilsson-Ehle of the Swedish agricultural experiment station for plant breeding at Svalof, one of the best authorities in that science, gives us a very logical scientific explanation of the occurrence of these False Wild Oats, as being apparent mutants occurring through disturbance in the arrangement of certain hereditary units of characters in the reproduction. According to Dr. Nilsson-Ehle, the idea that the False Wild Oat is the product of crossing is absolutely out of question; he contends that such hybrids would show different characters and that the similarity to both of the parents would extend itself over a larger number of characters, instead of being confined to anatomical changes in the hulls and rachilla only. This explanation, though not appealing very much to those not versed in the scientific study of the laws of heredity, is probably the most plausible one, and we very much incline to accept it for the present at least or until further research proves it to be incomplete or wrong.